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APPLIED FORESTRY NOTES

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RELATIVE HUMIDITY OF THE ATMOSPHERE AND ITS RELATION TO THE FIRE PROBLEM.

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It is known that the warm air is able to hold as vapor more moisture than cold air and that this moisture leaves the air in form of dew, fog or rain whenever the air cools below a certain temperature. During the heat of the day the relative humidity is therefore much less than at night. Fires burn more briskly during the heat of the day not only because there is more heat and atmospheric circulation but also because there is less moisture in the dead needles and twigs at this time. This is shown in the following table:

Fluctuations in Moisture Content of Dead Pine Needles According to the Relative Humidity of the Atmosphere Priest River Forest Experiment Station.

Hour	8 A.M.	10 A.M.	2 P.M.	4 P.M.	6 P.M.
Atmospheric Humidity	82	66	41	34	61
Moisture Content of Duff %	10.3	10.2	9.2	6.1	7.2

The table shows that the needles are dryest at 4 P.M. at the time of the highest air temperature and greatest wind movement. We have therefore three powerful factors working together to produce critical conditions for fires. It should be stated that the tests have shown that the dead needles do not burn freely with a flame when the moisture content is greater than ten or twelve per cent.

The following table shows more fully how the relative humidity varies by day and by night:

Hourly Relative Humidity
(Hygrograph %)

Sheridan, Wyo. July 1913 - April 1916.	A.M. 2	4	6	8	10	Noon	P.M. 2	4	6	8	10	12
May	80		82	67	56	50		48	50	64	73	77
June	83		82	63	53	48		48	53	65	76	81
July	74		78	58	47	44		39	43	53	68	71
Aug.	72		82	62	43	34		33	38	55	65	71
Sept.	81	83		70	50	41		41	49	67	75	80
Priest River, Idaho. July 1918				55	44	35	29	28				
Boise, Idaho.												
May	64	68		64	53	44	38			44	51	58
June	61	66		62	53	44	39	35		41	49	57
July	49	55		53	42	34	29	26		29	35	43
Aug.	46	51		52	40	32	26	22		27	32	40
Sept.	48	53	56		46	37	31		28	34	40	44

It goes without saying that there is less relative humidity in the atmosphere during the warmest summer months than in fall or spring. Data on this relation are given in the following table:

Table 3.--Mean Relative Humidity
District 1. (5-6 P.M.)

Station	Record	April	May	June	July	Aug.	Sept.	Av.
		0/0	0/0	0/0	0/0	0/0	0/0	0/0
Spokane	1890-1910 8 P.M.	39	38	33	25	25	35	32.5
Priest River	5 yrs. SW slope to 1916	51.9	52.8	50.8	46.5	38.9	66.2	52.5
Kalispell	(11 years (to 1916	49	49	47	37	36	50	44.7
Helena	21 yrs.	42	42	41	31	30	39	37.6
Havre	15 yrs.	44	45	43	35	34	44	41.2
Miles City	10 yrs.	56	51	51	42	42	52	49.0
Yellowstone Park	10 years to 1919	54	51	41	38.5	36	48	44.7

The average relative humidity for Spokane during July and August is 25 per cent, but from 36 to 38.5 per cent at Yellowstone Park and from 30 to 31 per cent at Helena. This evidently goes long ways toward explaining the more serious fire situation in Idaho than in to the east of the Continental Divide.

Yellowstone Park lies much higher than Spokane or Helena, to be sure, and for this reason we should expect a moister atmospheric condition at Yellowstone; but the differences are due mainly to somewhat greater precipitation during July and August east of the Divide and because Spokane and Idaho are more exposed to the dessicating winds coming from the dry region to the west over which the air is much heated in summer.

Considerable difference in the relative humidity of the atmosphere is found for different elevations; higher points show more relative moisture by day and less by night than low stations. Data showing this are given in the following table:

Relative Humidity on Mountain and in the Valley near Priest River Experiment Station.

	July		August		September	
Hour	Mtn.	Valley	Mtn.	Valley	Mtn.	Valley
3 A.M.	---	---	60	73	71	87
1 P.M.	70	32	49	26	62	47
5 P.M.	65	34	46	32	56	57

These conditions come about because the air temperature on the mountain is lower by day than in the valley and higher at night on the mountain than in the valley and because there is much more air movement at night on the mountain than in the valley. This explains why the fires burn so much more readily at higher elevations at night while they are less active in the valley or on the flats.

Somewhat similar conditions operate on the different aspects in that the air temperature on the northeast slope during July and August is about ten degrees lower in the afternoon than on the southwest aspect. However, since the air movement on the northeast aspect is only about one third as much as on the southwest the fire hazard is materially reduced on northerly slopes. The differences in relative humidity for different aspects for August and for the entire summer at the Experiment Station are given in the following table:

	NE Slope	SW Slope	Flat
August	47.1	38.9	44.1
May-Sept.	56.3	49.2	52.1

It has been found that the relative amount of water apor in the air affects visibility to a very marked degree. The ata set forth in the following table may not apply strictly to his territory but are of considerable interest from a standpoint f efficiency of lookouts. (John Aitken, in Proc. Royal Soc, dinb. v. 20, p. 548.)

Mean Limit of Visibility in Miles Falkirk, Eng.

	Depression of the wet bulb, degrees F.						
	2	3	4	5	6	7	8
Visibility	50	100	132	132	178	193	191